Winter Examinations 2018/ 2019

Exam Code(s)	4BCT1
Exam(s)	4 th Year Examination Computing Science and IT
Module Code(s)	CT421
Module(s)	Artificial Intelligence
Paper No.	1
Repeat Paper	No
External Examiner(s)	Professor Jacob Howe
Internal Examiner(s)	Professor Michael Madden
	*Dr. Conn Mulvihill
	*Dr. Finlay Smith

Instructions: Answer 2 questions from each section. All questions will be marked equally. Use a separate answer book for each section.

Duration	2 hours
No. of Pages	3
Discipline(s)	IT
Course Co-ordinator(s)	

Requirements: None

Section A

1.
   a. Describe the Fuzzy Inference element of a Fuzzy Logic Controller (FLC). Include descriptions of the inputs and outputs from the FLC.
   (8 marks)
   b. Would it be possible to mix conventional "crisp logic" rules in a Fuzzy Logic Controller? Justify your answer.
   (8 marks)
   c. Describe 3 ways in which uncertainty can be introduced into a physical system. In each case identify a way that an AI system could handle the uncertainty.
   (9 marks)

2.
   a. What are the differences between Qualitative and Quantitative representations? Highlight the advantages of each representation. Illustrate your description by considering the description of 5 objects on a table.
   (10 marks)
   b. In Mycin type systems, if the Certainty Factor (CF) for a conclusion X was deduced by three different rules to be 0.8, 0.7 and -0.3, what would be the combined CF? (Show your workings)
   (10 marks)
   c. Would the order in which the CFs from part b. were combined affect the overall output? Justify your answer.
   (5 marks)

3.
   a. Some of the AI searches are similar to searches that can be applied to conventional data structures (trees, graphs etc.). What are the differences between the AI versions and the conventional versions?
   (8 marks)
   b. Which AI search would you use for each of the following (justify your answers):
      i. Searching for a state that you know can be reached in 6 state transitions.
      ii. Searching for a state that lies deep down in the search space. It isn't necessary to find the shortest path.
      iii. Searching for a state that possibly lies deep down in the search space. It is necessary to find the shortest path.
   (6 marks)
   c. What is required to be known about a physical system if GDE is to be used to diagnose faults in it?
   (6 marks)
   d. What are the differences between GDE, GDE+ and Sherlock?
   (5 marks)

Section B

4.

Consider the following high-level version of the Bellman-Ford algorithm, based on Cormen. Bellman-Ford is capable of dealing with negative weights in a graph.

Inputs: A directed graph G containing a set V of n vertices, and m directed edges with arbitrary weights in an edge set E. s is a source vertex drawn from the set of vertices V

Set *shortest*[v] to infinity for each vertex v except s, set *shortest*[s] to 0, set *pred*[v] to NULL for all vertices
For i taking on values from 1 to N -1 :
        For each edge (u, v) in the edge set E
                If *shortest*[u] + *weight* [u,v] < *shortest*[v] then
                      set *shortest*[v] to *shortest*[u] + *weight* [u,v]
                      set *pred*[v] to u

    a. based on the above, outline how the Bellman-Ford algorithm works
       (8 marks)
    b. Explain why the algorithm works
       (10 marks)
    c. Discuss how to locate a negative weight cycle (if there is one) after Bellman-Ford has run
       (7 marks)

5.

    a. In the context of genetic algorithms, explain what is meant by the term 'fitness function'
       (8 marks)
    b. Suppose that you are solving the travelling salesman problem (TSP) via a genetic algorithm. A tour notated 1.2.5.4.6.3.1 visits city 1 then city 2 then city 5 then city 4 then city 6 then city 3 and then returns back to city 1. With reference to the above tour, explain what issues may arise with the crossover and mutation operators and suggest any one solution for each of these problems
       (12 marks)
    c. Does a genetic algorithm always find a solution in your view?
       (5 marks)

6.

A report in October 2018 from Deloitte considered the deployment of AI in the enterprise. By considering this report, or otherwise, discuss the current state of AI in the enterprise under the headings (a) current deployment of any two AI technologies (10 marks) (b) cybersecurity, legal and regulatory risks (15 marks).